Threads of Mission Success

Project Management Challenge 2006 Galveston, TX

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Threads of Mission Success

NASA/JPL Interaction & Communications

NASA/JPL Institutional Requirements

Planning

Mission/System Reqts/Design/Implement

Science Interaction

Technical Division/Section Interaction

Financial

Assessment, Review and Control

US and Foreign Partner Interaction

Verification & Validation

Safety and Mission Assurance

Independent Assessment, Review & Reporting

A Project Manager Has Many Threads to Work With



Threads of Mission Success

Threads are:

- Key topics and interactions that:
 - Are critical to mission success
 - The PM has to pay attention to continuously
- Highly interactive with each other:
 - If one thread is compromised, the whole mission may be compromised
- Topics form the basis of a JPL Project Manager Workshop

NASA/JPL Interaction & Communication

NASA Mission Directorate Roles and Responsibilities

JPL Director/Director for Roles and Responsibilities

Program Manager Roles and Responsibilities

Project Manager Roles and Responsibilities

Working With Other Centers

Regulatory Agreements

Launch Approval, Planetary Protection, Export Control,

Frequency Assignment.....

Support Agreements

Launch Services, DSMS......

Reviews

- Status Reviews, Significant Events
- Milestone & Decision Reviews

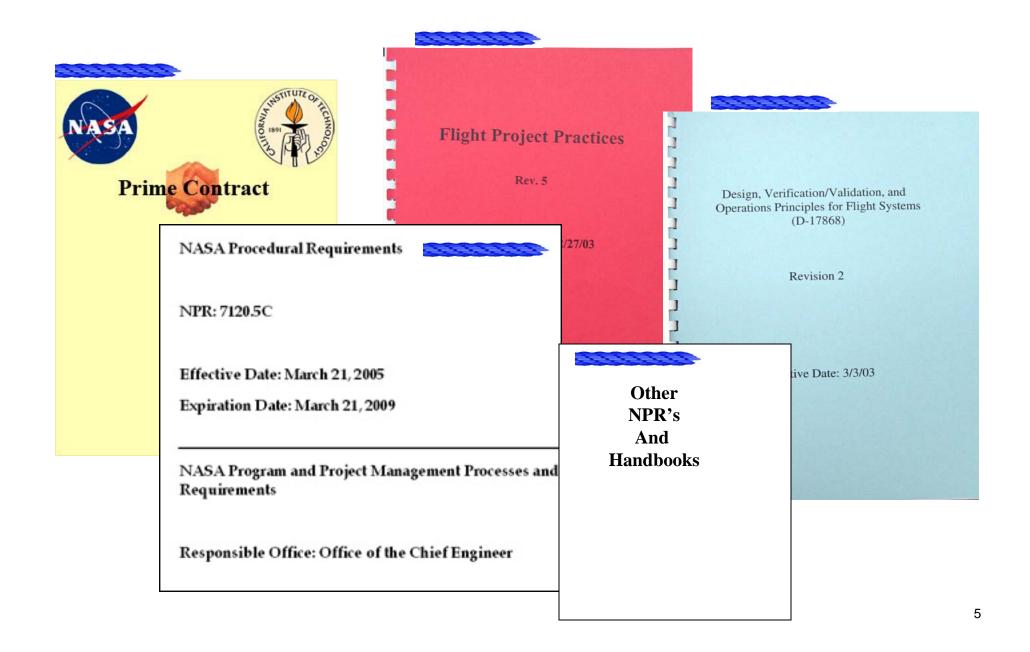
Independent Assessments

Key personnel

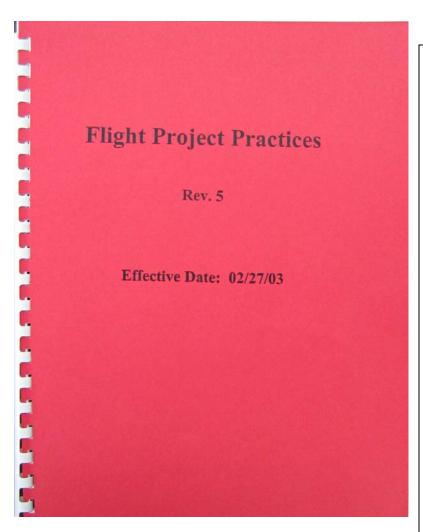
Coordination before changes



NASA/JPL Institutional Requirements-



Flight Project Practices



- Applies to all projects regardless of implementation mode
- Specifies what projects are required to do
- Projects meet requirements, or get approval for deviation/exception
- Communicates the JPL way of doing business, both internally and to sponsors
- Provides for projects the JPL implementation of 7120.5
- Establishes standards of uniformity
- Initial compliance assessment is via the FPP Compliance Matrix
- Compliance verification process
- Deviations/Exceptions process
- Flight practices

(Rules! DocID 58032)

Flight Project Practices Rev 5 Content

Section 6

Engineering

Practices

Note: Sections 1-4 are Applicability, Purpose, Implementation, and Approval/Change Authority

Section 5 Management **Practices** 5.1 Life Cycle 5.2 Planning 5.3 Science 5.4 Project Organization 5.5 Work Breakdown Structure 5.6 NEPA Compliance & Launch Appl 5.7 Spares, Testbeds, and Models 5.8 Make-or-Buy Decisions 5.9 Scheduling, Cost Estimating, Etc 5.10 Information, Data Mgt & Archiving 5.11 Level 1 Descope Planning 5.12 Project Staffing & Destaffing 5.13 Acquisition 5.14 Project & Institutional Reporting 5.15 Reviews 5.16 Risk Management 5.17 Waivers 5.18 Crisis Response 5.19 Science Data Management 5.20 Ext Comm & Public Engagement 5.21 Lessons Learned 5.22 Margins & Margin Mgt **5.24 ITAR**

6.1 Mission Design 6.2 Telecommunications Design **6.3 Mission Operations** 6.4 System Engineering 6.5 L/V and Launch Operations 6.6 Inheritance 6.7 Planetary Protection 6.8 Flt Sys Fault Tolerance/Redundancy 6.9 Flight Hardware Logistics 6.10 Materials, Processes, and **Contamination Control** 6.11 Software Development 6.12 Design & Verification for **Environmental Compatibility** 6.13 System Level Functional V&V 6.14 Configuration Management 6.15 Orbital Debris 6.16 Hardware Development 6.17 Mission Ops System Development

Section 7 Safety & Mission Assurance **Practices** 7.1 Mission Assurance Management 7.2 Reliability Engineering 7.3 Quality Assurance 7.4 Software IV&V 7.5 Electronic Parts Reliability, **Application and Acquisition** 7.6 Problem Reporting 7.7 Mission Operations Assurance

Design, Verification/Validation, and Operations Principles for Flight Systems (D-17868) Revision 2 Effective Date: 3/3/03

(Rules! DocID 43913)

Design Principles

- Applies to all flight designs, whether implemented in-house or at a contractor
- Specifies essential attributes of JPL flight designs
- Projects meet requirements, or get approval for deviation/exception
- Captures 40+ years of lessons learned
- Establishes robust design margins for high reliability
- Defines ample margins for management of development risk
- Defines a level of risk acceptable to management
- Engages management in dialog, when deviations are taken, of the risks being accepted
- Prevents management from being surprised by unacceptable risk at a time when it is too late to change the outcome
- Initial compliance assessment is via the DP Compliance Matrix
- Compliance verification process
- Deviations/Exceptions process
- Design principles

Design Principles Rev 2 Content

Section 6

Managed

Margins

Section 7

Flight

Sequence

Design

Note: Sections 1 and 2 are Applicability and Introduction

Section 5

Software

Section 4 Section 3 Flight Mission System Design Design 4.1 General 4.2 Mechanical Configuration/Systems 4.3 Power/Pyrotechnics 4.4 Information System 4.5 Telecommunications System 4.6 Guidance, Navigation & Control 4.7 Propulsion System 4.8 System Thermal 4.9 System Fault Protection 4.10 System EMC/EMI 4.11 Flight Software System 4.12 Flight Hardware System

6.1 Project Programmatic Resource Margins 6.1.1 Budget Reserve 6.1.2 Schedule Margin 6.2 Mission Design Resource Margins 6.2.1 Propellant 6.3 Flight System Development **Resource Margins** 6.3.1 General 6.3.2 System Mass 6.3.3 System Power 6.3.4 System Energy 6.3.5 Flight Software Margins 6.3.6 Power/Pyro System Margins 6.3.7 Telecom System Margins 6.3.8 Flight Hardware Margins

8.1 General 8.1.1 Min Op Times for Electronics 8.1.2 Handling & Test Constraints 8.2 Pre-delivery Verification 8.2.1 Subsystem and Assembly Level 8.2.2 Early Interface Testing 8.2.3 System Level 8.3 System Assembly, Integration & Test 8.3.1 System Assembly 8.3.2 System Integration 8.3.3 System Functional Verification 8.3.4 Flight Sequence Verification 8.3.5 System Fault Protection Verification 8.3.6 System Stress Testing 8.3.7 System Environmental Verification 8.3.8 Inter-system Verification 8.4 Launch Operations 8.4.1 Pre-mate Verification 8.4.2 Post-mate Verification

Section 8

Flight System

V&V

Design

Section 9

Flight System

Flight Ops

Design

Planning

JPL Project Lifecycle
Phase Transitions

Gate Products

Organization

Standard WBS

Integrated Scheduling

Project Plan and PIP

Acquisition Strategies

Contingencies

NASA APPROVAL Lifecycle IMPLEMENTATION **FORMULATION** Phases **JPL** Pre-Phase A Phase A: Phase B: Phase C: Phase D: Phase E: LifeCycle Advanced Mission & Systems Preliminary Design & ATLO Operations **Phases Studies** Definition Design Build Major JPL Reviews Project Mission & Preliminary ATLO Operations & Post Critical Events Mission Concept Critical (Note: Major Review (MCR 1,3) Systems Review Mission Design Design Readiness Launch Readiness JPL reviews (PMSR 14) Review (PDR) Review Readiness Assmnt Review are followed Reviews Review (CERR 5) by a Directors (ORR3 & (PLAR3) GPMC unless otherwise For Competed Missions indicated) Step 1 TMC Step 2 TMC 2 PMSR 2.4 Major NASA Concept Decision Preliminary NAR Non-Advocate Production Mission Briefing Reviews Review 7 (PNAR) or Initial Review (NAR) or Review 7 CR (ÍCR)1,8 Confirmation Review (CR)6 Commitment Contract Launch Events For Competed Missions Down Select for Step 12 Selection for Step 22 (1) For assigned missions (4) A PMSR is equivalent to what the old Code S called a combined Mission Definition Review and SRR (2) For competed missions (5) CERRs are established at the discretion of Program Offices (3) Not a GPMC review (6) NAR/PNAR if Agency PMC is governing, CR/ICR if Mission Directorate or Center PMC is governing (7) For Spiral Development Projects 03/28/2005

Margins, Reserves, Options, Descopes

JPL Institutional Support

Project Support Team, Templates,

PSO Website, Costing Office, Scheduling Section.....

Mission/System Reqts/Design/Implement

Design Principles

System Engineering

- Project, Flight, Ground

Requirements Flowdown

System Acquisition

Inheritance

Software

Technology Infusion

System Complexity

Cross System Trades

- Flight System drivers on MOS, etc.

Integration and Test

 Payloads/Subsystems from many diverse suppliers

Technical Resource Management

Materials and Processes



Science Interaction

Project Manager and PI Roles and Responsibilities

Science Objectives/Requirements

Science Management

Organization, teams

Science Data

Acquisition, management, analysis, distribution, archiving

Education and Public Outreach



JPL Technical Division/Section Interaction

Implementing Projects Within JPL's Matrix Organization

Project Roles and Responsibilities

Technical Division/Section Roles and Responsibilities

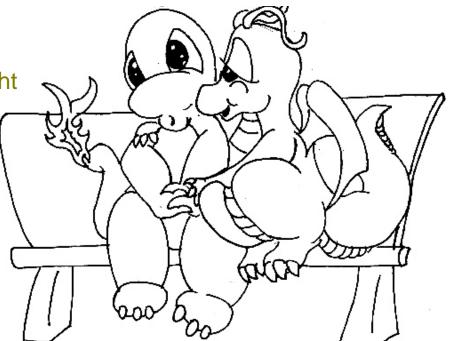
Co-chair Design Reviews

Peer Reviews

Contractor Insight/Oversight

Staffing/Destaffing

Quiet Hours



Financial

Project Cost Estimation

- Cost Database
- Costing Guidelines

Standard WBS

Earned Value

Cost Risk Analysis

Budget Reserves

- Reserve Requirements
- Reserve Use Strategy

Cost Liens

Costing Office

533 Reporting



Assessment, Review and Control



US and Foreign Partner Interaction

- NASA, JPL, US Partners and Foreign Partners Roles and Responsibilities
 - May involve other agencies
- MOU's
 - Foreign Partners, Other Centers
- Acquisition Process
 - Collaboration
 - Geographically distributed partners
 - Information Sharing
 - Cultural issues
- Export Control/ITAR
 - TAA
- Risk and Cost sharing



Verification & Validation

V&V Matrix

Incompressible Test List

All Levels

- Project
- Flight System, Subsystems, Assemblies, Parts
- Software
 - IV&V
- ATLO
- Ground System
- Mission Operations

Test as You Fly/Fly as You Test

Certification of Flight Readiness



Safety & Mission Assurance

Roles and Responsibilities

- Mission Assurance
- Systems Safety
- Environmental Assurance
- Reliability
- Parts
- HW and SW Quality Assurance
- Environmental Health and Safety

SMA Interaction with Mission and Flight System Teams

How much SMA

SMA Interaction with US and Foreign Partners

Other NASA centers, Industrial,
 Educational, Foreign......

Mission Operations Assurance

Post Launch SMA Roles & Responsibilities



Independent Assessment, Review & Reporting

JPL Red Teams

SMQA Risk Matrix

NASA Directorate/Agency GPMCs

IPAO

ITA



Weaving the Threads of Mission Success

A Project
Manager Weaves
A Successful
Mission from
A Broad Collection
Of Threads



